

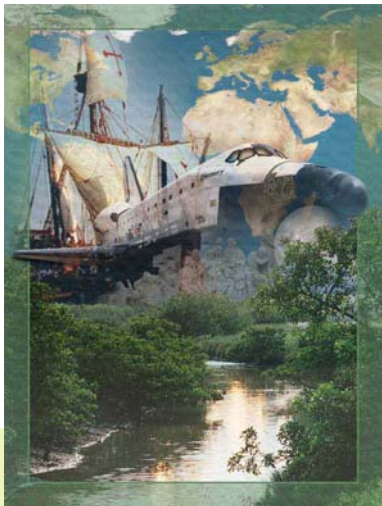
## ***“INTERNATIONAL POLLUTION PREVENTION WORKSHOP”***

**Joint Partners in Pollution Prevention  
Partnering for Success**

# ***Pollution Prevention Activites at INEGI*** ***(Institute of Mechanical Engineering and industrial Management)***

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# OUTLINE

## 1. Energy and Environment (CETERM)

- Eolic Area
- Environment Area
- Energy Area
- Training
- Industrial R&D Projects, Case of Study – COVs System Treatment for BIAL Portugal

## 2. Foundry and New Technologies (CETECOFF)

- Lead-free copper-zinc alloys

# ***1. ENERGY AND ENVIRONMENT (CETERM)***

## ENERGY AND ENVIRONMENT (CETERM)

### ➤ Eolic Area



- ✓ Support to the development of the Renewables Energies
- ✓ Management of Eolic Resource Evaluation Campaign
- ✓ Productivity and optimization calculation for Wind Farms configurations.

## ENERGY AND ENVIRONMENT (CETERM)

### ➤ Eolic Area



- ✓ Technical and economic viability study of projects for Wind Farms installation.
- ✓ Support on the installations licensing
- ✓ Proposal for appreciation, comparison of solutions and evaluation of the turbines performance

## ➤ Environment Area



- ✓ Characterization of the Industry Effluent Emissions
- ✓ Environmental Noise Analysis
- ✓ Environmental Audits and Diagnostics

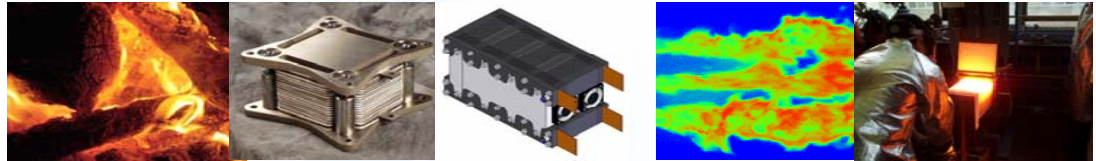


## ➤ Environment Area



- ✓ Consulting for ISO 14001 and EMAS Environmental Systems Management Implementation
- ✓ Waste Management Plans
- ✓ R&D Projects

## ➤ Energy Area

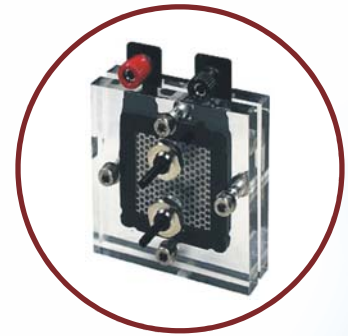
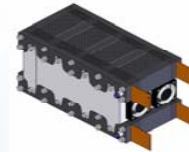


- ✓ Specialized Consulting on the following areas:
  - ✓ Flow Characterization ,
  - ✓ Combustion,
  - ✓ Drying,
  - ✓ Pneumatic Transportation
  
- ✓ Energetic Audits and Diagnostics in Buildings and Industrial Installations



## ENERGY AND ENVIRONMENT (CETERM)

### ➤ Energy Area

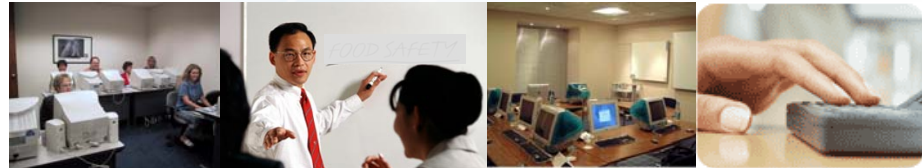


✓ Support to the development of Fuel Cells

✓ New Laboratory for Fuel Cell Tests

✓ R&D Projects

## ➤ Training



- ✓ Training guided for the improvement of technical board superiors and managers
- ✓ Specialized Training to the Industry Sector

## ➤ Industrial R&D Project Area

### *Case of Study*

*COVs System Treatment  
for a  
Portuguese Pharmaceutical Company - BIAL Group*

## ENERGY AND ENVIRONMENT (CETERM)

- ✓ *Bial is a pharmaceutical group which has the mission to discover and supply therapeutic solutions in the area of Health. BIAL products have been caring responsibly for Health since 1924.*
- ✓ Respect for the environment is the outcome of incorporating Good Environmental Practices in all BIAL group's activities.
- ✓ BIAL assume the responsibility to fulfill the Portuguese Environment Legislation and has taken the option of implementing the standard ISO 14001.

## ENERGY AND ENVIRONMENT (CETERM)

- ✓ INEGI was chosen for the activities of Engineering Project Research, Development and Implementation.
- ✓ The basic idea was developing an Innovative Air Treatment System for COVs in three production exhaustions.
- ✓ It was assumed that the installation would reduce the COVs emissions to a maximum of  $20\text{mg/m}^3 \text{ N}$ , which is lower than the Portuguese legislation limit of  $50\text{mg/m}^3 \text{ N}$ .

## **ENERGY AND ENVIRONMENT (CETERM)**

**INEGI mission was held on the following subjects:**

- ✓ **Study of the best national and international available technology for this specific project**
- ✓ **Calculation analysis, computer simulation and technical drawing**
- ✓ **Execution project**



## ENERGY AND ENVIRONMENT (CETERM)

The project has evolved the implementation of three treatment units for the following data:

	Exhaustion	Pollutant	Conc COVs mg/m <sup>3</sup> N	Conc COVs ppm	Q m <sup>3</sup> /h	T °K	Work time h/year	Conc. Pollutant mg/m <sup>3</sup> N
<b>Unit 1</b>	Litzen	Ethylic Alcool	<b>8513</b>	15883	500	305	350	14600
<b>Unit 2</b>	Driacoter	Isopropyl Alcool Methylene Chloride	<b>3086</b>	5757	2420	313	574	4486
	Allgaier	Ethylic Alcool Isopropyl Alcool Acetone	<b>1136</b>	2119	3360	319	73	1620
	Accelacota	Isopropyl Alcool Methylene Chloride Metanol	<b>1158</b>	2906	2293	319	1392	1620

## **ENERGY AND ENVIRONMENT (CETERM)**

Engineers from INEGI and BIAL concluded that the best technical and economical solution for this particular case was a unit treatment, constituted by two activated carbon beds, which will work on an alternated way:

- ✓ **Activated Carbon Bed 1 – Adsorption Process**

- ✓ **Activated Carbon Bed 2 – Regeneration System with Water Vapor**

## ENERGY AND ENVIRONMENT (CETERM)

The system detects automatically the moment when the Activated Carbon Bed 1 saturates, changing automatically in order to the effluent flow to the second activated carbon bed.

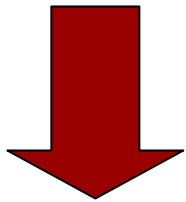
Each integrated system for COV's treatment was basically composed by the following units:

- ✓ Effluent Aspiration
- ✓ Effluent Treatment
- ✓ Carbon Activated Regeneration
- ✓ Effluent Discharge

## *2. Foundry and New Technologies (CETECOFF)*

# **LEAD-FREE COPPER-ZINC ALLOYS**

## **Study new copper-zinc alloys for the foundry (low pressure and tilt casting) and forging industry.**



**Replace/reduce the 2-3% lead by other materials (Bi, Se, etc.) that are environmental friendly, but that can ensure:**

- **Casting properties**
- **Forging and machining characteristics**
- **High quality products**

## JUSTIFICATION AND RELEVANCE IN TERMS OF POLLUTION PREVENTION

- ***Lead is a dangerous heavy metal*** that can cause severe problems to the environment and human health, namely in contact with drinking water.
- Ingots and forging rods suppliers still have their main brasses products containing copper, zinc and lead.
- ***Lead*** gives good foundry properties and plastic behaviour during casting or extrusion and imparts the intense machining grinding and polishing, necessary for the final products appearance and functionality, but these processes smears the lead across the surface, ***leaving it vulnerable to leaching***.



## JUSTIFICATION AND RELEVANCE IN TERMS OF POLLUTION PREVENTION



- International organizations have been establishing very low lead values in drinking water:
  - 15 ppb/l at the tap, in USA
  - <10 ppb/l in lead flushed from the tap, in Canada
  - 25 ppb/l in Portugal (10 ppb/l in 2015)
- New low-lead or lead-free alloys are required for plumbing fittings to meet the reduced toxicity levels.

## **JUSTIFICATION AND RELEVANCE IN TERMS OF POLLUTION PREVENTION**

- Other elements, like Bismuth, Indium or Selenium, are potential lead substitutes to promote similar characteristics to the copper-zinc alloys:
  - Machinability (ease, chip ejection, speed and cost)
  - Fluidity
  - Cracking resistance
  - Ease of plating and soldering
  - Pressure tightness

## EXPERIMENTAL WORK

- Diagnosis of the forging and casting Portuguese industrial sectors, considering house hardware and taps manufacturing companies and ingot industrial manufacturers.
- Inquire to identify the manufacturers needs and strategic position relative to the lead problem.
- Bibliographic review about the currently used casting and forging copper alloys and their technological properties.
- Compilation about the needs and the strategic positions of the forging and casting sector in Portugal and eventually in Spain, Germany and other countries, relatively to this problem.

## **EXPERIMENTAL WORK**

- Extension of the partnership, in case of necessity, in order to cover all the areas, from the remelting (ingot production) to the final components.
- Laboratory tests to check the technical implications of the new alloy system:
  - Metallurgical
  - Embrittlement
  - Machinability
  - Physical and foundry properties
- Study the workplace hazards and their effects on the human health and the environmental implications of foundry emissions, wastes and recyclability of these alloys.

## EXPERIMENTAL WORK

- Laboratory tests to identify the big differences in the feeding and solidification phenomena between the old and the new alloys.
- Machinability tests of some benchmark components to identify the differences and establish the final new machining solutions.
- Industrial tests of tilt pouring and, in a later phase, the low pressure die-casting.
- Industrial tests of forging and machining
- Conclusions and dissemination of the results, economical evaluation and demonstrations for the forging and casting sectors and ingot manufacturers.

## *Foundry and New Technologies (CETECOFF)*

# EXPERIMENTAL WORK

INEGI have a considerable experience in the foundry field, using copper alloys

## Human and Laboratory facilities

- Human
  - 5 PhD researchers in the metallurgical field.
  - Several engineers and lab and foundry technicians
- Equipment:
  - Emission spectroscopy
  - Induction and heat treatment furnaces
  - Die casting
  - Machining
  - Metallographic analysis
  - Mechanical tests



## **DEMONSTRATION AND TESTING ACTIVITIES**

1. Change the production methodology
2. First phase in the taps manufacturing lines, which are the ones with more direct contact with drinking water
3. Second phase in house hardware.



**Thank you**